OAS retro-reflective sensor with OAS V09-D, OAS V10-D and OAS V10-A electronic sensor evaluation

Assembly and Operating Manual

Translation of the original manual

Dear Customer,

Congratulations on choosing a SCHUNK product. By choosing SCHUNK, you have opted for the highest precision, premium quality and optimum service.

You are going to increase the process reliability of your production and achieve best machining results – to the customer's complete satisfaction.

SCHUNK products are inspiring.

Our detailed assembly and operation manual will support you.

Do you have further questions? You may contact us at any time - even after purchase. You can reach us directly at the addresses provided in the last chapter of this manual.

Best regards,

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Table of contents

1 About this manual

1.1 Purpose/validity

This manual forms part of the module and describes the safe and proper use during all phases of operation.

This manual is valid only for the module specified on the front page.

1.2 Target groups

Target group	Task
Manufacturer, operator	➔ Keep this manual accessible for personnel at all times. ➔ Require personnel to read and observe this manual and the applicable documents, especially the safety notes and warnings.
Skilled personnel, fitters	➔ Read, observe and follow this manual and the applicable documents, especially the safety notes and warnings.

Table 1

1.3 Applicable documents

You can find the following documents on our homepage:

Document	Purpose
Catalog	Technical data and application parameters for the module and information on accessories. The respective latest version is valid.
Assembly and operating manuals for sensors	Detailed information about assembly, adjustment and commissioning of the sensors.
General terms of business	Including notes on the warranty.

Table 2

1.4 Symbols in this manual

To give you quick access to information, the following symbols will be used in this guide:

Symbol	Meaning
⚠ WARNING	Dangers for persons. Non-observance can cause death or serious injuries.
⚠ CAUTION	Dangers for persons. Non-observance can cause minor injuries.
❗ CAUTION	Information on avoiding material damage.
➔	Instruction for action, including measures in a warning or note.
1. 2. 3. ...	Step-by-step instruction for action. ➔ Observe the order.

Table 3

2 Basic safety notes

2.1 Appropriate use

The module is intended for installation in a machine. The requirements of the applicable guidelines must be observed and complied with.

The module may be used only in the context of its defined application parameters.

The retro-reflective sensor is to be used in combination with a suitable gripper (MPG+ or PGN+) in a suitable size and in a clean environment. Its purpose is either to detect a workpiece between the jaws or to determine the rough distance of the gripper to a collision object.

Any other use or use exceeding that specified is an infringement of appropriate use. The manufacturer bears no liability for damage resulting from such use.

2.2 Ambient conditions and operating conditions

➔ Use the module only in the context of its defined application parameters (see chapter 4, page 9 and catalog).

➔ Make sure the environment is clean and the ambient temperature corresponds to the specifications as per the catalog.

➔ Make sure that the environment is free from splash water and vapors as well as from abrasion or processing dust.

2.3 Process reliability

The module is state of the art and complies with the recognized safety rules at the time of delivery. However, it can present risks if, for example:

- The module is not used in accordance with its intended purpose.
- The module is not installed or maintained properly.
- The EC Machine Directive, the VDE directives, the safety and accident-prevention regulations and environmental protection regulations valid at the usage site, or the safety and installation notes are not observed.

2.4 Personnel qualification

Assembly, initial commissioning, maintenance, and repair of the module may be performed only by trained specialist personnel.

Every person called upon by the operator to work on the module must have read and understood the complete assembly and operating manual, especially the chapter 2 "Basic safety notes". This applies particularly to personnel only used occasionally, such as maintenance personnel.

2.5 Safety-conscious working

➔ Avoid any manner of working that may interfere with the function and operational safety of the module.

➔ Observe the safety and accident prevention regulations valid at the site of use.

2.6 Notes on particular risks

⚠ WARNING

The sensor does **not** constitute a safety component and is intended merely to detect objects.

➔ Observe machine directives and accident prevention guidelines.

➔ Do not use the sensor as a safety component.

3 Warranty

The warranty is valid for 12 months from the date of delivery to the production facility under the following conditions:

- Intended use in 1-shift operation
- Ambient conditions and operating conditions are observed (see chapter 2.2, page 7)

4 Scope of delivery

The scope of delivery comprises:

- OAS object-distance sensor suitable for PGN-plus gripper or MPG-plus gripper
- Force/torque sensor system controller in variant ordered:
  - OAS V09-D
  - OAS V10-D
  - OAS V10-A

Note that these components need to be ordered separately. For details of ID numbers, see catalogue.

5 Technical data

You can view additional technical data in our catalog.
The respective latest version is valid.

Product type	OAS V09-D	OAS V10-D	OAS V10-A
Mechanical operating data			
Weight [g]	55	65	60
Housing material	ABS	ABS	ABS
Ambient temperature Min. [°C] Max. [°C]	 -10 +55	 -10 +55	 -10 +55
IP rating	IP65	IP65	IP65
Electrical operating data			
Power supply Min. [VDC] Max. [VDC]	 10 30	 10 30	 15 30
Own current consumption Ø [mA] Max. current [mA]	 40 180	 45 180	 45 180
Limit frequency [Hz]	500	500	-
Output signal	digital	digital	analog
Output current [mA]	100	200	-
Output voltage [VDC]	-	-	0…10
Functional principle	Clocked	Clocked	Clocked
Operating display	Green LED	Green LED	Green LED
Signal display	Yellow LED	Yellow LED / 7-segment display	Yellow LED / 7-segment display

Table 4

6 Assembly

⚠ WARNING

Possible risk of injury due to sudden movements!

➔ During assembly/disassembly and when teaching the sensor, the automated system/module concerned must be enabled.

➔ Work on the module may be carried out only by qualified specialist personnel.

CAUTION

Risk of damage to the sensor!

Ensure gripper fingers and sensor do not collide when assembling the sensor.

➔ Design the gripper fingers accordingly.

➔ Follow the assembly instructions.

6.1 Assembly of force/torque sensor system controller

Assembly

The force/torque sensor system controller must be assembled on a top-hat rail (included in scope of delivery):

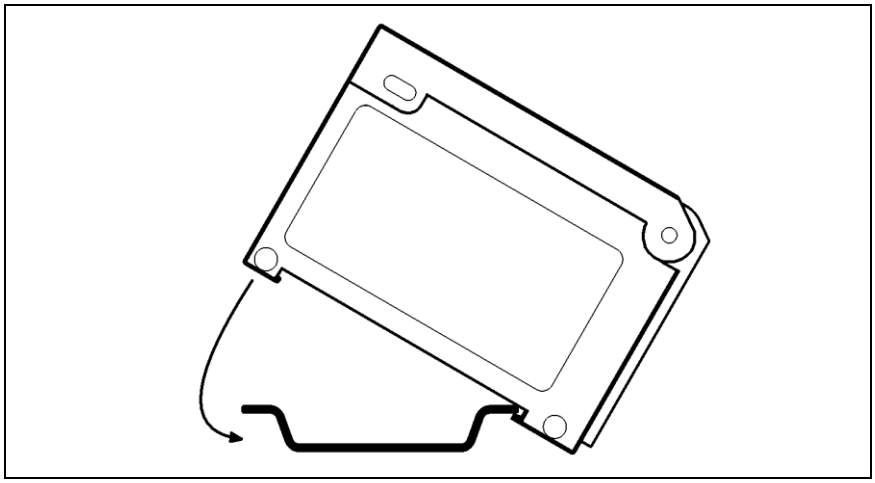


Fig. 1 Assembly of force/torque sensor system controller

1. Secure the top-hat rail at the desired location.
2. Place the force/torque sensor system controller on the top-hat rail. (see Fig. 1)
3. Connect the force/torque sensor system controller to the supply voltage.

Alternatively

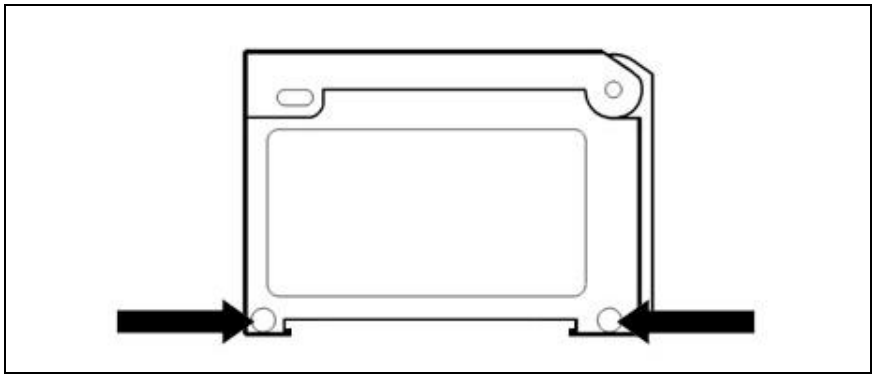


Fig. 2 Alternative assembly of force/torque sensor system controller

If mounting on a top-hat rail is not possible:

➔ Secure the force/torque sensor system controller with screws using the two lateral bore holes on the bottom of the housing.

Disassembly

1. Remove all cables and connectors.

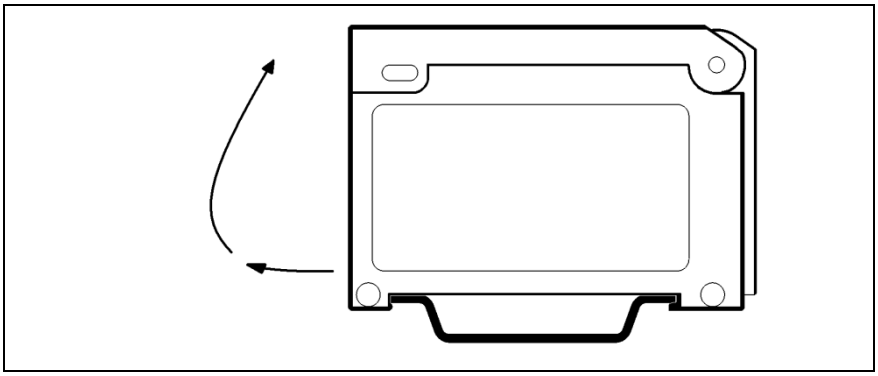


Fig. 3 Disassembly of force/torque sensor system controller

2. Remove force/torque sensor system controller from the top-hat rail.

6.2 Assembling the sensor on the PGN-plus gripper

CAUTION

Risk of damage to the sensor!

Ensure customized gripper fingers and sensor do not collide when assembling the sensor.

➔ Design the gripper fingers accordingly.

➔ Follow the assembly instructions.

CAUTION

Risk of damage to the sensor!

➔ The cable must be aligned to the side of the gripper on which the two grooves for assembly of the magnetic switches are located.
The other side can be used for mounting the gripper.

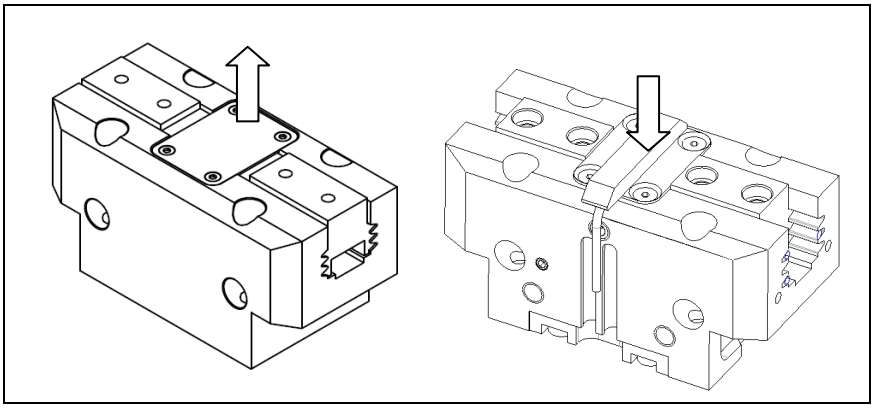


Fig. 4

1. Remove the gripper's cover plate.
2. Assemble the sensor in place of the cover plate. To do this, use the cover plate screws.
3. Connect the sensor to the force/torque sensor system controller.

6.3 Assembling the sensor on the MPG-plus gripper

CAUTION

Risk of damage to the sensor!

Ensure customized gripper fingers and sensor do not collide when assembling the sensor.

➔ Design the gripper fingers accordingly.

➔ Follow the assembly instructions.

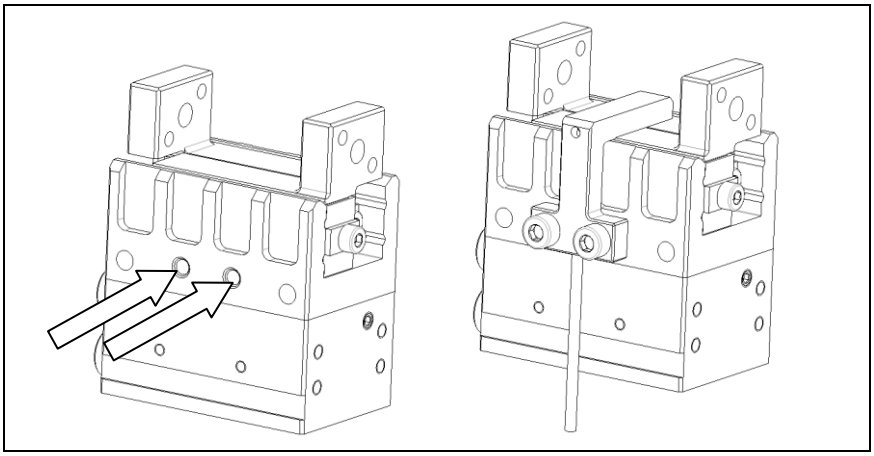


Fig. 5 Assembling the sensor

1. Screw sensor onto the side of the gripper housing using the bore holes provided. The sensor should point in the direction of the gripper fingers.
   Two M3 screws are required for this, which must be provided by the customer.
2. Connect the sensor to the force/torque sensor system controller.

6.4 Electrical connection OAS V09-D

Note
Observe the maximum electrical energy values (see chapter 5, page 10).

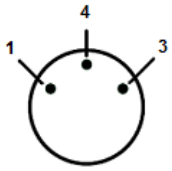
Type	Sensor, M8, 3-pin	Force/torque sensor system controller output
Assignment		Open wire strands
	1 +transmitter 4 GND/shielding 3 +receiver	brown +VCD blue -GND black Signal output

Table 5 Electrical connection components of the V09-D

6.5 Electrical connection OAS V10-D

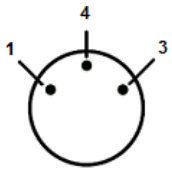
Type	Sensor, M8, 3-pin	Force/torque sensor system controller output
Assignment		Open wire strands
	1 +transmitter 4 GND/shielding 3 +receiver	brown +VCD blue -GND black Signal output pink Teach input white Alarm output

Table 6 Electrical connection components of the V10-D

6.6 Electrical connection OAS V10-A

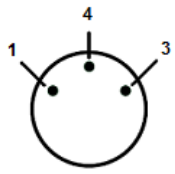
Type	Sensor, M8, 3-pin	Force/torque sensor system controller output
Assignment		Open wire strands
	1 +transmitter 4 GND/shielding 3 +receiver	brown +VCD blue -GND black Analog output + pink Teach input white Analog GND +

Table 7 Electrical connection components for the V10-A

7 Notes on use of sensor

7.1 Repeat accuracy

Repeat accuracy will fluctuate between 0.1 % and 0.5 % according to the distance between the sensor and the measuring object:

Measuring distance	30 mm	100 mm	200 mm
Switching point deviation	0.2 mm	0.24 mm	0.96 mm
% (of maximum distance)	0.1 %	0.12 %	0.48 %

Table 8 Repeat accuracy

Values are based on optimal ambient conditions i.e.

- The sensor being shielded against sunlight
- No electromagnetic interference factors.

7.2 Use of an extension cable between sensor and force/torque sensor system controller

We recommend the system is operated without the use of an extension cable.

CAUTION

Interference may occur and output signal may jump spontaneously due to EMC load when using an extension cable between sensor and force/torque sensor system controller!

➔ Note the following method for teaching the sensor.

In case of data cable malfunctions between sensor and force/torque sensor system controller due to electromagnetic influence, proceed as follows when teaching the sensor:

1. Determine the distance at which an object is to be detected.

2. Multiply the value you measure for distance by a factor of 1.5 then use this for teaching the sensor.

This method guarantees that the digital output signal remains stable even in case of fluctuating analog values.

Example:
The measuring distance measured during operation is 100 mm. Since an extension cable is attached between sensor and force/torque sensor system controller, which is exposed to EMC load, the special method of teaching has to be used. The teaching distance in this case is 1.5 * 100 mm = 150 mm. During operation, the sensor will now extend far enough above the switching point so that it cannot reach the switching level in case of signal fluctuations due to EMC.

Note
If no cable extension is used for the sensor, there is no need to use this method.

7.3 Influence of workpiece surface

The surface and shape of the object to be gripped have a direct influence on the signal strength and therefore on the switching point of the force/torque sensor system controller.

The following generally applies for teaching:

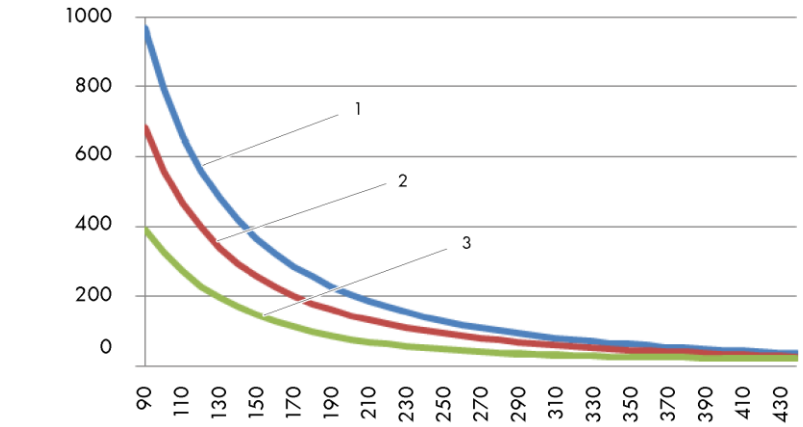
➔ Move gripper fingers to the desired position.

➔ Use the same gripper fingers as during operation.

➔ Use the same workpiece that is also to be gripped during operation.

➔ Use the same lighting conditions as during operation.

Failure to heed the above points may lead to the switching point changing during operation. This may lead to the object being detected too late or not at all.



1 White paper 2 Aluminum 3 Black film

Fig. 6 Influence of different surfaces on signals

CAUTION

Possibility of a duplicated switching point

If the sensor is moved significantly closer to the measuring object, the curve will no longer rise constantly. In case of direct contact, the signal strength will be virtually '0'.

➔ Always observe the minimum distance to the measuring object.

If the sensor is taught at a signal strength of 400 for instance, the switching range is between 90 and 150 mm, depending on the surface of the workpiece.

The following table contains factors that will help you to gauge your own application scenario. These factors are based on a maximum distance of 250 mm using white Kodak photographic paper.

Surface material	Type of reflection	Factor
Aluminum, finished, blank	Reflective	3.2..3.8
Brass, rolled	Reflective	2.9…3.6
Aluminum, finished, black-anodized	Reflective	2.4…2.8
VA steel, drawn blank	Reflective	2.1…2.6
PVC gray, untreated	mixed	0.6…1.1
PVC black, untreated	mixed	0.5…1.0
Kodak card, gray	diffuse	0.52
Foam rubber, black	diffuse	approx. 0.04
Aluminum, sawn	mixed	approx. 2.5-3.2
Aluminum, dirty	mixed	approx. 2.1-2.8

Table 9

For example:
Finished aluminum is to be detected at virtually the maximum scanning distance attainable by the sensor:
250 mm * 3.2…3.8 = 800…950 mm.

7.4 Influence of contamination

The product meets the requirements of IP 65. Loads which exceed this protection class may reduce the life span or cause failure of the sensor or force/torque sensor system controller.

Contamination such as chippings and cooling lubricant on the workpiece or on the fingers will cause significant changes to the sensor signal. The sensor therefore needs to be taught using the following method:

1. Determine the distance at which an object is to be detected.
2. Multiply this distance by a factor of 1.5 then use this for teaching the sensor.

This method guarantees that the digital output signal remains stable even in case of fluctuating analog values (e.g. due to the different positions of the chips).

For example:
The measuring distance measured during operation is 100 mm. Since there is contamination caused by chippings, teaching must be carried out as follows:
The teaching distance here is 1.5 * 100 mm = 150 mm.
During operation, the sensor will now extend far enough above the switching point so that it cannot reach the switching level in case of signal fluctuations due to the contamination.

7.5 Influence of gripper fingers

Besides the workpiece surface, the shape and surface of the gripper fingers may also have an influence on the signal strength. Attention must also be paid to the position of the fingers. The gap width s here indicates the distance between two gripper fingers.

CAUTION

The switching point may be adjusted and machine parts may be damaged or destroyed.

➔ The sensor must be taught under the conditions and using the workpieces used later during operation.

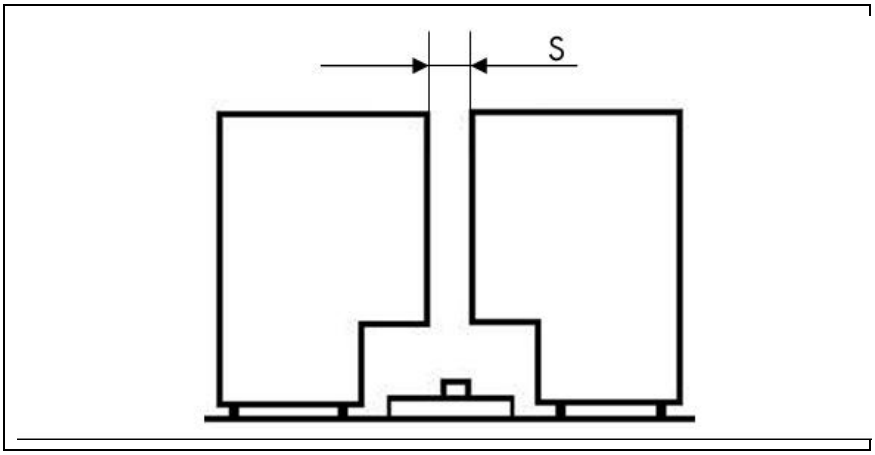


Fig. 7 Definition of gap width s

Notes

- The closer the gripper fingers are together, the closer the object needs to taught to obtain a significant signal value. Particularly with a narrow gap width, the sensor needs to be shielded from ambient light. → Saturation.
- In case of black gripper fingers, the switching point may be reached in closed position even though no object is located directly within the light beam.
- The shape of the finger must be selected so that the gripper fingers have no effect on the sensor result in any gripping state.

Example 1

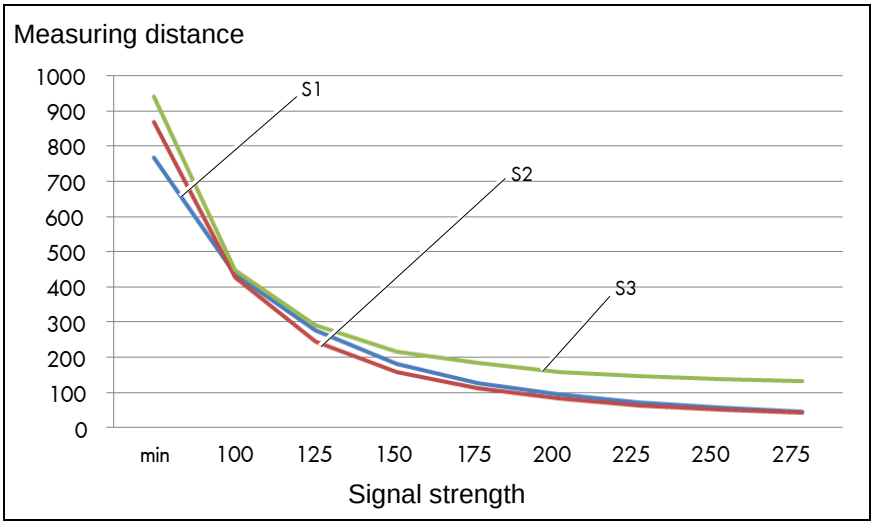


Fig. 8

Finger material: Aluminum
gap width: s1: 23 mm
s2: 14.5 mm
s3: 6 mm

Example 2

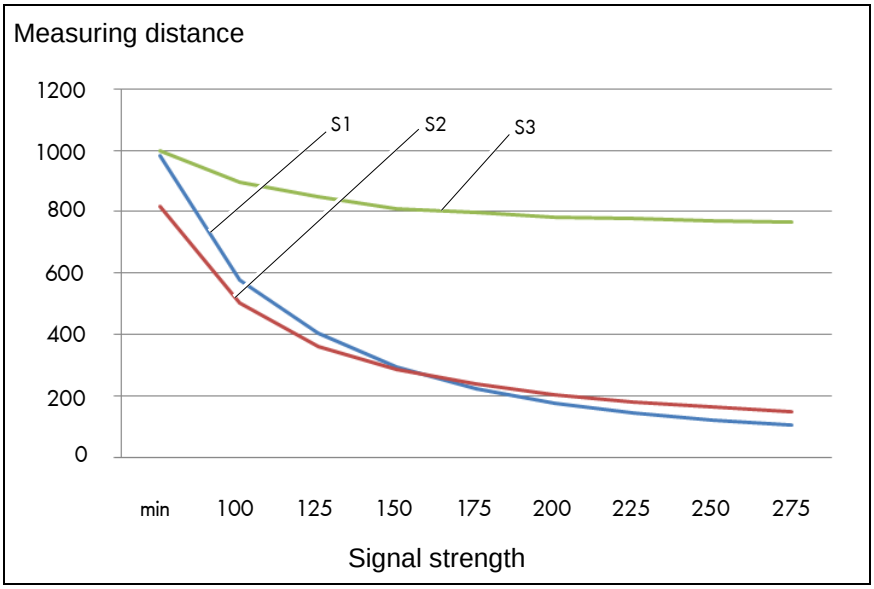


Fig. 9

Finger material: Black plastic
gap width: s1: 23 mm
s2: 14.5 mm
s3: 6 mm

7.6 Influence of temperature

CAUTION

Possible damage to model or automated system!

Factors like ice or condensation water will change the signal value and therefore the sensor's switching point.

➔ Always take environmental factors into account when teaching the sensor.

The electronic system is fully functional within a temperature range from –10 to +55°C.
Significant temperature fluctuations may however occur during operation and the resultant environmental influences may affect the sensor signal. This may lead to an erroneous output signal.

7.7 Influence of external light sources

The sensor can essentially be used with normal ambient lighting (factory lighting etc.). The sensor should however be protected from direct sunlight during operation. If it is not, the sensor may become saturated so that it can no longer detect objects.

7.8 IP protection class

The product meets the requirements of IP 65. Loads which exceed this protection class may reduce the life span or cause down-time of the sensor or force/torque sensor system controller.

8 Adjusting the V09-D force/torque sensor system controller

8.1 Signal display

Fig. 10 Front view - force/torque sensor system controller OAS V09-D

You can choose between various operating modes on the force/torque sensor system controller using the selector switch (arrow). The green LED indicates a safe signal state. The yellow LED shows the switching condition at the output.

8.2 Settings on the force/torque sensor system controller

You can set when the switching signal is to be present at the output on the force/torque sensor system controller:

- in case of light on the receiver
  - light switching (LIGHT ON)
  - or darkening, dark switching (DARK ON).

You can also set pulse extension, which extends the output signal by 50ms.

➔ Set the selector switch to DLY L/D ON.

➔ Switch on pulse extension using the (+) button (yellow LED lights up) or switch it off (yellow LED goes out).

➔ Using the (–) button, activate light switching (yellow LED lights up) or dark switching (yellow LED goes out).

8.3 Teaching the switching point

Note
We recommend using automatic mode (AUT) on the force/torque sensor system controller to set the switching point and, if required, then carrying out fine adjustment manually.

8.3.1 Automatic mode (AUT)

For automatic mode, set the selector switch to AUT position.

The switching point can be set automatically in three ways:

- Fully-automatically
- Two-point method
- Switching threshold can be set to a certain position

Fully-automatically

1. On the left, next to the LEDs, press the (+) or (–) button for between 3 and 60 seconds.

   During this time, the force/torque sensor system controller will adjust itself while operation is in process, thereby generating the optimal switching threshold.

   The green LED will flash rapidly for approx. 3s and then go out.

2. After releasing the button, the green LED will flash slowly for approx. 2s when the setting operation has been successful. The setting operation is then finished and the current value is saved.

Two-point method

1. While the object is located within the light beam, press the (+) button.
2. Now, when no object is located within the light beam, press the (–) button.

   Confirmation with these buttons will generate two measurement values. The force/torque sensor system controller will set the switching threshold precisely between these values.
   The green LED will flash rapidly during the setting operation. Once the setting operation is successful, the LED

will flash slowly for approx. 2 s. The setting operation is then finished and the current value is saved.

Setting switching threshold to a certain position

1. Place the object at switching position.
2. Press (+) and (–) briefly in succession.

   The force/torque sensor system controller will now fix the switching point at this position.
   During the setting operation, the green LED will flash rapidly. Once the setting operation is successful, the LED will flash slowly for approx. 2 s. The setting operation is then finished and the current value is saved.

8.3.2 Manual mode (MAN)

The switching threshold can be either set or finely adjusted manually.
The starting point for the setting is the last relevant value saved (factory setting: maximum range).

1. Set the selector switch to MAN position.
2. To increase the **range**, press the (+) button until the desired signal safety is attained.
   ALTERNATIVELY
   To lower the **range**, press the (–) button until the desired signal safety is attained.

9 Adjusting the V10-D/A force/torque sensor system controller

9.1 Signal display

Fig. 11

You can choose between various menu items on the force/torque sensor system controller using the selector switch (arrow). The green LED indicates electricity, gas and water supply is present. The yellow LED shows whether the switching point has been reached or not. In the 7-segment display, the signal strength is shown as a value between 0 and 999.

9.2 Settings on the force/torque sensor system controller

Use the selector switch to select a menu item. To the left of this is the jog switch, which can be used to make settings in the menu items. You can move the jog switch up (+) or down (–). Pressing on the jog switch will enable you to select individual menu items.

The following options are available as menu items: OUT (signal options), OPT (amplifier options), TEA (teach menu) and RUN (operating mode).

OUT menu item

d – l : Switches between light switching (lon) and dark switching (don)

OFd: Off delay 0…250 ms

Ond: On delay 0…250 ms

➔ See chapter 9.3.2 page 32.

OPT menu item

PLc: Lock setting Yes/no

trn: Rotate display by 180°

dOF: Switch off display no/yes

HyS: Hysteresis setting as a % of the signal value taught (3; 6, 9; 12); default:12

dEF: Reset to factory settings Yes/No

➔ See chapter 9.3 page 30.

TEA menu item

Aut: Automatic teach

IPt: 1 point method

2Pt: 2 point method

FIt: Fine adjustment

- POt: Potentiometer 0…127
- Abs: Change absolute value 0…999
  The entire switching range is moved.
- tLo: Change lower switching threshold 0…999
- tHi: Change upper switching threshold 0…999
- ALH: Change alarm level 0…999
- ret: Back to "Fit"

RUN menu item

0…999: Current signal value

Jog +: Display upper switching threshold

Jog -: Display lower switching threshold

9.3 Teaching the switching point

Note
We recommend using automatic mode AUT on the force/torque sensor system controller to set the switching point and, if required, then carrying out fine adjustment manually.

9.3.1 Settings in the TEA menu

To teach a switching point, set the selector switch on the OAS V10-D/A to TEA to enter the teach menu. You can select the individual menu items using the jog switch.
The following three teaching methods are available:

- Fully-automatic
- Single-point method
- Two-point method

Fully automatically

1. Set selector switch to TEA position.

   After a brief period, "Aut" will appear on the display.

2. Press the jog switch in to select the "Aut“ method.
3. While the "Aut“ indicator is flashing (approx. 30 times), move the object to be detected into the sensor beam and back out again.

   The sensor will automatically detect the data and specify the switching point.

4. Press the jog switch in to confirm the switching point.

   RdY will appear on the display telling you teaching of the new switching point has been successful.

5. Set selector switch to RUN position.

Single-point method

1. Set selector switch to TEA position.

   After a brief period, "Aut" will appear on the display.
2. Select the "IPt“ method with the jog switch.
3. Place the object to be detected within the sensor beam.
4. Press the jog switch in to confirm the "IPt" menu item.

   The sensor is now taught to this point and hysteresis has been set automatically.
5. Set selector switch to RUN position.

Two-point method

1. Set selector switch to TEA position

   After a brief period, "Aut" will appear on the display.
2. Select the "2Pt“ method with the jog switch.
3. Press the jog switch in to confirm the "2Pt" menu item.

   Note
   Place the object that causes the higher signal value within the sensor beam first. This is generally the brighter, more highly reflective object or that located closer to the sensor.
2. Placethe first object to be detected inside the sensor beam and remove it again.
3. Proceed in the same way with the second object you want to detect.

   The switching point is now set precisely between the two value determined. Hysteresis is now set automatically.
2. Set selector switch to RUN position.

Manual settings

The entire hysteresis range can be moved using the menu item "FIt" and manual changes then made to the values determined.

Possible changes are:

- High level
- Low level
- Alarm level

9.3.2 OUT

Light/dark switching

If a dark object is to be detected against a light surface, the output may switch to high after the switching point has been taught if no object is detected. As soon as the object comes within range of the sensor, the sensor will switch to low as the object is reflected more poorly than the subsurface.

The force/torque sensor system controller is equipped with light/dark switching for such cases. If switching is activated, the output signal is inverted and the output is set to low if there is not object. If an object is within range of the sensor, it is then set to high.

Off/on delay

The on delay can be adjusted so that an object is detected by the sensor within a certain time until the output is set to high.

This adjustable off delay will result in the time an object stays within the sensor beam being extended at the output signal if this is extremely short.

10 Troubleshooting

10.1.1 No LED lighting up on the force/torque sensor system controller?

Possible cause	Remedial measures
Supply voltage is not connected.	➔ Connect supply voltage.
Object distance is not optimal.	➔ Change distance to object or ➔ Reset range on force/torque sensor system controller.
Force/torque sensor system controller is defective.	➔ Replace force/torque sensor system controller.

Table 10

10.1.2 No switching signal being emitted by force/torque sensor system controller?

Possible cause	Remedial measures
No object in light beam	➔ Reset range on force/torque sensor system controller. ➔ Place object in light beam.
Connection cable of force/torque sensor system controller is not connected to sensor.	➔ Connect connection cable.
Connection cable of force/torque sensor system controller is defective.	➔ Replace sensor.
Sensor is set incorrectly.	➔ Reset range on force/torque sensor system controller.
Sensor is defective.	➔ Replace sensor.
With V10 type force/torque sensor system controller only: Light/dark switching set incorrectly.	➔ Set light/dark switching according to application scenario.

Table 11

10.1.3 Switching point has changed?

Possible cause	Remedial measures
Temperature has changed significantly or is even not within the operating conditions.	➔ Reset range on force/torque sensor system controller. ➔ Adjust environmental conditions to operating conditions.
Dirt on sensor optics.	➔ Clean sensor.

Table 12

10.1.4 Display emitting no values?

With V10 type force/torque sensor system controller only

Possible cause	Remedial measures
Supply voltage is not connected.	➔ Connect supply voltage.
Object distance is not optimal.	➔ Change distance to object or ➔ Reset range on force/torque sensor system controller.
Force/torque sensor system controller is defective.	➔ Replace force/torque sensor system controller.

Table 13

11 Maintenance

It is recommended dirt be removed from the lenses with a cloth at appropriate intervals depending on environmental conditions/ambient influences.

Should the switching point change due to new ambient conditions, this will need to be retaught.

12 EC Declaration of Conformity

Manufacturer/distributor	SCHUNK GmbH & Co. KG. Spann- und Greiftechnik Bahnhofstr. 106 – 134 74348 Lauffen/Neckar, Germany

CE

We hereby declare that the following product:

Product designation:	OAS retro-reflective sensor; electronic sensor evaluation
Type designation:	OAS; OAS V09-D, OAS V10-D and OAS V10-A
ID number:	308875 to 308880; 308891 to 308895; 308865; 308866

in its supplied condition, complies with the following relevant provision:
EC Directive on Electromagnetic Compatibility (2004/108/EC, in the version 89/336/EEC)

Applied harmonized standards, especially:

EN 60947-5-2 (:2004-11) Proximity switch

Location, date/signature:	Lauffen, Germany, January 2011	ppa.
Title of the signatory		Director, Development